

DIESEL TRADE THEORYNOTE:

- (i) Combined trade theory for Diesel Mechanics, Motor Cycle Mechanics, Motor Mechanics, Tractor Mechanics, Construction Plant Mechanics and Fuel Injection Mechanics for the National Technical Certificate Part 1 only, and combined trade theory for Diesel Mechanics, Tractor Mechanics, Construction Plant Mechanics and Fuel Injection Mechanics for the National Technical Certificate Parts 2 and 3.
- (ii) In teaching this subject, neat and well-proportioned sketches should form a supplementary part of the work.
- (iii) No questions will be set on how to overhaul or service components, however, teachers are encouraged to discuss fault diagnosis, causes and remedies and service procedures with students to give them better insight.

DIESEL TRADE THEORY N211

January 1981

(One 3-hour paper)

1. Gearboxes: Types of gears (spur, helical, double helical); gear trains; operation of three and four-speed synchromesh gearboxes; selector mechanisms; gearshift methods.
2. Drive shafts: Hotchkiss and torque-tube drives; rear axle torque reactions; torque arms; slip joints.
3. Universal joints: Function and operation; types in use for conventional prop-shafts and for front-wheel and four-wheel drives.
4. Final drives: Function and operation. Types: Spiral bevel; hypoid; worm drive; spur drive.
5. Differential: Function and operation; disadvantages of conventional differential.
6. Rear axles: Types of housings: Split and banjo. Half-axle mountings: Half, three-quarter and full floating; advantages and disadvantages.
7. Suspension: Types of leafsprings: Quarter and half elliptic. Transverse springs. Auxiliary overload springs; coil springs; torsion bars. Sprung and unsprung masses. Hydraulic and pneumatic suspension. Shock absorbers; function and operation of all types; ride control; anti-roll bars. Independent front and rear suspension, all types.

8. Steering gear: Steering boxes in general use including rack and pinion.
9. Wheel alignment and balance: Functions of the angles; Ackermann principle; camber; caster; king pin inclination; toe-in; toe-out on turns. Static and dynamic wheel balance.
10. Brakes: Function and operation of modern mechanical brakes; compensators; handbrakes; hydraulic brakes; operation of wheel-cylinder, master cylinders and tandem master cylinders; types of brakes; duo self energising and two-leading shoe; vacuum servo-brakes; disc brakes.
11. Fuel supply: Electrical and mechanical fuel pumps; fuel filters. Air filters: Function and operation, oil wetted gauze, oil-bath, poly-urethane and micronic filters.
12. Injectors: Function, construction and operation; mechanically operated; pressure operated. Nozzles, pintle, multihole, single, straight and offset.
13. Combustion chambers: Direct, pre-combustion and air cells; glow plugs; position of injector.

January 1981

(One 3 hour-paper)

1. Engines: Compression ratios. Calculation of compression ratio; limits of compression ratios from graph of $N = 1 - (1/r)^{0.4}$. Comparison between petrol and CI engines; effect of altitude on power. Crankshafts; balance; vibration dampers.
 2. Valves: Function and operation of the different types of poppet valves. Valve location: I and L head; F head; W-head; T-head. Camshafts, single and double. Valve timing diagrams, necessity for lead, lag and overlap; tappet clearance; timing gears, chains and tensioners.
 3. Fuel injection: Three methods, common rail, air injection and solid injection; injection pressures; injector pumps, in-line pumps; distributor type pumps (metering delivery valve, barrel and plunger, lifters, springs and camshaft), variable stroke; variable spill; governors, mechanical vacuum, hydraulic and spill timing; mechanical advance and period of injection.
 4. Phasing and calibration: Methods of phasing and calibration of pumps and injectors.
-
5. Fluid clutches: Function and operation fluid drives and torque convertors; comparison between fluid drives and torque convertors. Advantages of fluid clutches.
 6. Gearboxes. Epicyclic gearing: Function and construction of epicyclic gearing. Simple sketches of an epicyclic gear train to show how different gear ratios can be obtained (no calculations). Advantages and disadvantages of epicyclic gearing as compared to the conventional gear systems. Function and operation overdrives and free wheels. The fully automatic gearbox; advantages of the fully automatic gearbox as compared to the conventional gearbox. Construction and mechanical operation of the automatic gearbox. Diagrammatic representation of the control system. The function of pumps, check valves, primary and secondary oil pressure regulators, modulators, hand controlled valves and bands.
 7. Differentials and final drives: Limited-slip differentials. Two-speed and double reduction drives; tandem rear drives; four-wheel drives.
 8. Power steering: Function; advantages and disadvantages; construction and operation of power steering. Fault diagnoses, causes and remedies; steering dampers.
 9. Lay-out of the workshop: Garage lay-out; workshop lay-out - possible systems; flow line lay-outs; service areas for commercial vehicles, cars and other light motor vehicles; diagnostic section and equipment; washing and car valeting.
 10. Reception: Qualifications, responsibilities and authority of the receptionist; procedures and handling of customers' complaints; service records of vehicles and follow-up systems. Quality control of workshop repairs; inspection systems; service and sales. Job cards; courtesy and delivery.
 11. Contracts for repair services: Repairs; the time factor; the skill factor; the price factor; budgeting and selection of workshop equipment; inspection and control of tools and equipment.
 12. Garaging or parking: A brief treatment of owners risk.
 13. Supervising for shop safety: Reporting accidents. The accident register. Legislation on safety and health applicable to Motor Industry as set out in the Factories

DIESELVAKTEORIE

LET WEL:

- (i) Saamgestelde vakteorie vir Dieselwerktuigkundiges, Motorfietswerktuigkundiges, Motorwerktuigkundiges en Trekkerwerktuigkundiges, Aanlegmasjinerie-werktuigkundiges en ook Dieselpompwerktuigkundiges slegs vir Die Nasionale Tegniese Sertifikaat Deel I, en saamgestelde vakteorie vir dieselpompwerktuigkundiges, Trekkerwerktuigkundiges, Aanlegmasjien-werktuigkundiges en Dieselpomp-werktuigkundiges vir die Nasionale Tegniese Sertifikaat Dele 2 en 3.
- (ii) By die onderrig van hierdie vak behoort netjiese handsketse in goeie verhouding n aanvullende deel van die werk uit te maak.
- (iii) Geen vrae van hoe om onderdele op te knap of in te stel sal gevra word nie, maar onderwysers word nogtans aangemoedig om foutspewing sowel as oorsake van foute en herstelprosedures met die studente te bespreek om die student sodoende n beter insig in die vak te laat verkry.

DIESELVAKTOERIE N211

Januarie 1981

(Een 3-uurvraestel)

1. Ratkaste: Rattipes (reguittandrat, heliese, dubbelheliese); ratreekse; werking van drie- en vierspoed gesinkroniseerde ratkaste; selektormeganisme; ratwisselmetodes.
2. Dryfasse: Hotchkiss- en wringbuisaandrywing; agteraswringreaksies; wringarms; skuifkoppeling.
3. Kruiskoppeling: Funksie en werking; tipes in gebruik vir konvensionele dryfasse en vir voorwiel- en vierwiel-aandrywings.
4. Eindaandrywings: Funksie en werking. Tipes: spiraalkeëlrat; hipofederat; wurmaandrywing; reguittandrat-aandrywing.
5. Ewenaar: Funksie en werking; nadele van konvensionele ewenaar.
6. Agterasse: Omhulsels; verdeelde- en banjo-tipes. Halfasmonterings: Halfas; driekwartvryas; volvryas; voordele en nadele.
7. Vering: Tipes bladvere; kwart- en halfeliptiese. Dwarsvere. Oorlashulpvere; spiraalvere; torsiestaaftvere. Geveerde en ongeveerde massas. Hidroulies-pneumatiese veerstelsels. Skokbrekers; funksie en werking van alle tipes; rybeheer; kanteldempers. Onafhanklike voor- en

agterwielveringstelsels, alle tipes.

8. Stuurwerk: Stuurkaste in algemene gebruik insluitend tandstang en kleinrat.
9. Wielsporing en balans: Funksies van die hoeke; Ackermanbeginsel; wielvlug; nasporing; krinkspilhelling; toesporing; oopsporing om draaie. Statiese en dinamiese wielbalans.
10. Remme: Funksie en werking van moderne meganiese remme; kompenseerders; handremme; hidrouliese remme; werking van wielsilinder, remhoofsilinders en tandemremhoofsilinders; remtipes; selfbekragtende en twee-leiremskoensamestellings; vakuumservoremme; skyfremme.
11. Brandstof toevoer: Elektriese en meganiese brandstofpompe; brandstof-filtreerders. Lugfiltreerders: Funksie en werking; oliebad tipe; poli-uretaan en mikronfiltreerders.
12. Inspuiters: Funksie, konstruksie en werking; met meganiese werking gestel; met drukwerking. Spuitstukke: spilpen, veelstraal, enkel, reguit en geknik.
13. Verbrandingskamers: Direk, voorverbranding- en lugkamers; gloeiproppe; plasing van inspuiter.

Januarie 1981

(Een 3-uurvraestel)

1. Enjins: Drukverhoudings; drukverhoudingsberekeninge; beperking van drukverhoudings volgens die grafiek van $N = 1 - (1/r)^{0,4}$. Vergelyking tussen petrol en kompressie-ontsteking-enjins. Uitwerking van hoogte bo seespieël; krukasse; balans; trillingsdempers.
2. Kleppe: Funksie en werking van die verskillende soorte stootkleppe. Klepposisies: I- op L-kop; F-kop; W-kop; T-kop. Nokasse, enkel en dubbel. Klepreëlingdiagramme, klepspel; reëlratte, kettings en kettingverspanners.
3. Brandstofinspuiting: Drie metodes, gemeenskaplike aftakpyp, luginspuiting en soliede inspuiting; inspuitingsdruk; inspuiterpompe; in-lyn-pompe; verdelertipe-pompe (reëlleweringsklep, silinder en plunjer, ligters, vere en nokas), reëlbare slag; reëlbare oorloop; reëllaars, meganiese vakuum, hidroulies en oorloopreëling; meganiese vervroeging en inspuitingsperiode.
4. Fasering en kalibrering: Metodes vir fasering en kalibrering van pompe en inspuiter.
5. Vloeistofkoppeling: Funksie en werking van vloeistof-aandrywing en koppelomsitters; vergelyking tussen vloeistofaandrywings en koppelomsitters. Voordele van vloeistofkoppeling.
6. Ratkaste: Episikliese ratreeks; funksie en konstruksie van episikliese ratwerking. Eenvoudige sketse van n episikliese ratreeks om aan te toon hoe verskillende ratverhoudings verkry kan word (geen berekeninge nie). Voordele en nadele van episikliese ratreeks in vergelyking met konvensionele ratsamestellings. Funksie en werking van snelratte en vrywielmeganismes. Die volle outomatiese ratkas; voordele van die volle outomatiese ratkas in vergelyking met die konvensionele ratkas. Konstruksie en meganiese werking van die outomatiese ratkas. Diagrammatiese voorstelling van die beheerstelsel. Die funksie van die pompe, beheerkleppe, primêre en sekondêre oliedrukreëllaars, moduleerder, handbeheerde kleppe en rembande.
7. Ewenaars en finale aandrywings: Beperkteglip-ewenaar. Tweespoed- en dubbelreduksie-aandrywings; tandemagteraandrywings; vierwielaandrywing.
8. Kragstuur: Funksie; voordele en nadele; konstruksie en werking van die kragstuur. Foutraspeuring, -oorsake en herstelprosedures; stuur-skokdempers.
9. Werkplaasaanleg: Garage-aanlegte, werkwinkeluitleg, moontlike stelsels; vloeilynuitlegte; diensareas vir kommersiële voertuie, motors en ander ligte motorvoertuie; diagnoseeringsafdeling en uitrusting; was en algehele bakversiering.
10. Ontvangs: Kwalifikasies, verantwoordelikheid en outoriteit van die ontvangsklerk; prosedures en behandeling van kliënte se klagtes; diensrekords van voertuie en opvolgstelsels. Kwaliteitsbeheer van werkwinkel-herstelwerk; inspeksiestelsels; diens en verkope; werkkaarte; hoflikheid en aflewering.
11. Kontrakte vir hersteldienste: Herstelwerk; die tydfaktor; die bekwaamheidsfaktor; die prysfaktor. Begroting en seleksie van werkwinkeluitrusting; inspeksie en beheer van gereedskap en uitrusting.
12. Stalling of parkering: n Beperkte behandeling van eienaar se risiko.
13. Toesighouding oor werkplaasveiligheid: Aanmelding van ongelukke. Die ongeluksregister. Wetgewing op veiligheid en gesondheid van toepassing op die Motorbedryf se Industrieë soos uiteengesit in die Wet op Fabriek (1941) soos gewysig.